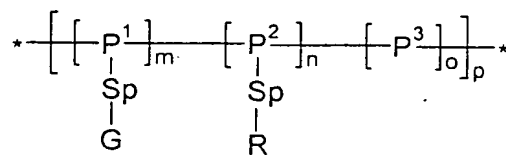


Patent Claims

1. A polymer dopant comprising at least one electron accepting group that is bound to the polymer to induce or enhance the charge carrier mobility or electrical conductivity of said polymer.
2. A polymer according to claim 1, wherein the electron accepting group is covalently incorporated in a polymer main chain or covalently bound, optionally via a spacer group, as a side group or part of a side chain, to a polymer backbone.
3. A polymer according to claim 1, said polymer containing recurring units of formula I



wherein

- P^{1-3} are, independently of each other, a group forming a polymer backbone,
- Sp is, each independently, a spacer group or a single bond,
- G is an electron accepting group,
- R is an organic group that modifies the surface energy of the polymer,
- m, n, o are, independently of each other, 0 or 1, wherein in each recurring unit of formula I $m + n + o > 0$, and in at least one of these recurring units m is 1, and

p is an integer from 1 to 500,000.

5 4. A polymer according to claim 3, wherein p is an integer from 10 to 500,000.

10 5. A polymer according to claim 3, wherein R is C₁-C₂₀-fluoroalkyl, C₁-C₁₅-perfluoroalkyl, -(Si(R⁰R⁰⁰)-O)_r-R⁰⁰⁰ or (CH₂CH₂O)_s, wherein R⁰, R⁰⁰ and R⁰⁰⁰ are, independently of each other, H or alkyl with 1 to 12 C-atoms, r is an integer from 1 to 15, and s is an integer from 1 to 6.

15 6. A polymer according to claim 2, wherein the polymer backbone comprises maleic anhydride (co-)polymer, maleimide (co-) polymer, polyacrylpolyacrylate, polymethacrylate, poly-α-haloacrylate, poly-α-cyanoacrylate, polyacrylamide, polyacrylonitrile, polymethylene malonate, polymethylene maleimide, polyester, polyamide, polyimide, polyphosphazene, polyurethane, polysiloxane, polyepoxide, polyvinylalcohol, 20 polyvinylether, polyvinylpyrrolidone, polyethyleneimine, polyalkylene, polycarbonate, or polystyrene or copolymers thereof.

25 7. A polymer according to claim 2, wherein the spacer group is of formula II



wherein

30 Sp¹ is a single bond or an alkylene with 1 to 20 C atoms which is unsubstituted, mono- or poly-substituted by F, Cl, Br, I, CN or OH, in which optionally one or more non-adjacent CH₂ groups are replaced, in 35 each case independently from one another, by -O-, -S-, -NH-, -NR⁰-, -SiR⁰R⁰⁰-, -CO-, -COO-, -OCO-, -

OCO-O-, -S-CO-, -CO-S-, -CH=CH- or -C≡C- in such a manner that O and/or S atoms are not linked directly to one another,

5 X^1 and X^2 are, independently of each other, -O-, -S-, -NR⁰-, -CO-, -COO-, -OCO-, -O-COO-, -CO-NR⁰-, -NR⁰-CO-, -OCH₂-, -CH₂O-, -SCH₂-, -CH₂S-, -CF₂O-, -OCF₂-, -CF₂S-, -SCF₂-, -CF₂CH₂-, -CH₂CF₂-, -CF₂CF₂-, -CH=N-, -N=CH-, -N=N-, -CH=CH-, -CR⁰=CR⁰⁰-, -CY¹=CY²-, -C≡C-, -CH=CH-COO-, -OCO-CH=CH- or a single bond,

Y¹ and Y² are, independently of each other, H, F, Cl or CN,
and

15 R^0 and R^{00} are, independently of each other, H or alkyl with 1 to 12 C-atoms.

20 8. A polymer according to claim 7, wherein the spacer group is of formula,

*-Alkyl-CO-NH- IIa,

*-Alkyl-COO- IIb,

25

*-Alkyl-O- IIc,

*-Alkyl-NH- IId,

30 *-Alkyl- lle,

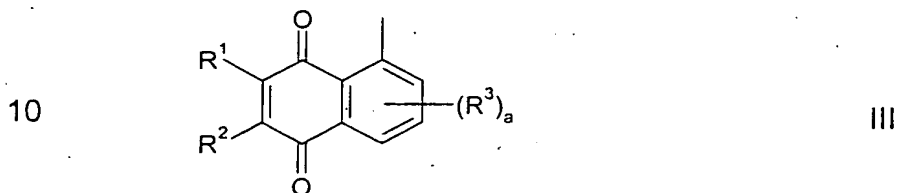
*-Alkyl-CH(OH)-CH₂-NH- If, or

$$^*\text{-Alkyl-CH(OH)-CH}_2\text{-O-} \quad \text{IIg,}$$

35

wherein Alkyl denotes an alkyl, fluoroalkyl or oxaalkyl group with 1 to 15 C atoms, and the asterisk denotes the side that is linked to the polymer backbone.

- 5 9. A polymer according to claim 1, wherein the electron accepting group is of formula III



wherein

- 15 R¹ and R² are, independently of each other, H, halogen or CN,

- 20 R³ is, in each occurrence independently of one another, H, halogen, CN, NO₂, NR⁰R⁰⁰, or straight chain, branched or cyclic alkyl with 1 to 20 C-atoms, which is unsubstituted, mono- or polysubstituted by F, Cl, Br, I or CN, and wherein one or more non-adjacent CH₂ groups are optionally replaced, in each case independently from one another, by -O-,
- 25 -S-, -NH-, -NR⁰-, -SiR⁰R⁰⁰-, -CO-, -COO-, -OCO-, -OCO-O-, -SO₂-, -S-CO-, -CO-S-, -CH=CH- or -C≡C- in such a manner that O and/or S atoms are not linked directly to one another,

- 30 R⁰ and R⁰⁰ are, independently of each other, H or alkyl with 1 to 12 carbon atoms, and

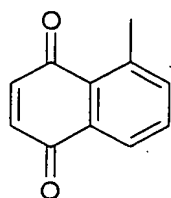
a is 0, 1, 2 or 3.

- 35 10. A polymer according to claim 1, wherein the electron accepting group is an optionally substituted quinone or cyanoquinone, or

an aromatic or conjugated non aromatic group that is mono- or polysubstituted by cyano, halo, haloalkyl, nitro or ester groups.

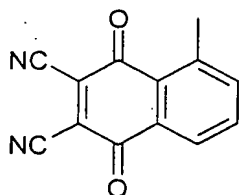
11. A polymer according to claim 10, wherein the electron accepting group is of formula

5



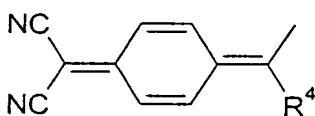
10

IIIa,



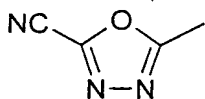
15

IIIb,



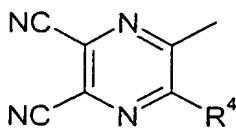
20

IVa,



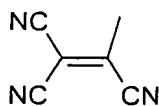
25

Va,



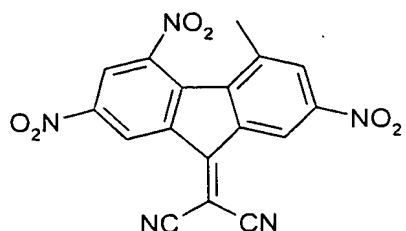
VIa,

30

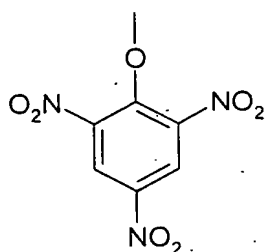


VIIa,

35



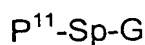
VIIIa,
or



IXa,

wherein R^4 is H, halogen, CN, NO_2 , NR^0R^{00} , or straight chain, branched or cyclic alkyl with 1 to 20 C-atoms, which is unsubstituted, mono- or polysubstituted by F, Cl, Br, I or CN, and wherein one or more non-adjacent CH_2 groups are optionally replaced, in each case independently from one another, by -O-, -S-, -NH-, - NR^0 -, - $\text{SiR}^0\text{R}^{00}$ -, -CO-, -COO-, -OCO-, -OCO-O-, - SO_2 -, -S-CO-, -CO-S-, -CH=CH- or -C \equiv C- in such a manner that O and/or S atoms are not linked directly to one another.

12. A polymer according to claim 1, further comprising at least one organic group that modifies the surface energy to the polymer, said organic group being covalently bound, optionally via a spacer group, to the polymer backbone.
13. A polymer according to claim 12, wherein the organic group lowers the surface energy of the polymer.
14. A monomer of formula I1



wherein Sp is a spacer group or a single bond, and

G is an electron accepting group, and

5 P¹¹ is a polymerizable group which can react into a polymer backbone.

10 15. A polymerizable material comprising one or more monomers according to claim 14 and optionally one or more monomers of formula I2 and/or I3

P²²-Sp-R

I2

P³³

I3

15

wherein R is an organic group that modifies the surface energy of the polymer,

Sp is a spacer group or a single bond,

20

P²² is a polymerizable group which can react into a polymer backbone, and

25

P³³ is a monomer which upon polymerisation gives a polymer backbone.

30

16. A semiconductor, electrical conductor or photoconductor component or material, an optical, electrooptical or electronic device, a field effect transistor, integrated circuitry, a thin film transistor, a flat panel display, a radio frequency identification tag, a semiconducting component, an organic light emitting diode, a charge transport or electroluminescent component, an electroluminescent display, a backlight of a flat panel display, a liquid crystal display, a photovoltaic, photoconductor or sensor device, an electrode material, a battery, an electrophotographic

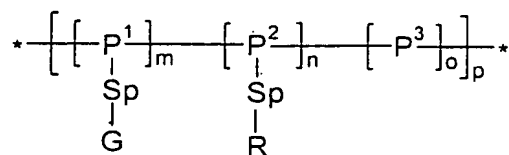
35

device or electrophotographic recording, comprising a polymer according to claim 1.

- 5 17. A molecularly dissolved or dispersed polymer blend comprising a polymer according to claim 1 and a semiconducting polymer in a semiconductor matrix.
- 10 18. A discrete thin film layer comprising a polymer according to claim 1 that is in direct contact with a semiconductor material.
- 15 19. An organic material having charge carrier mobility, comprising one or more organic semiconductor components and one or more polymer dopant components, wherein at least one polymer dopant component is a polymer as defined in claim 1.
- 20 20. An organic material according to claim 19, wherein the one or more semiconductor components and the one or more polymer dopant components form a mixture, solution, dispersion or polymer blend.
- 25 21. A semiconductor, electrical conductor, photoconductor, electrooptical or electronic material, component or device, comprising an organic material according to claim 19.
- 30 22. A semiconductor, electrical conductor, photoconductor, electrooptical or electronic material, component or device, comprising at least one layer of an organic semiconductor material, and at least one layer of a polymer according to claim 1 that is in direct contact with said semiconductor layer.
- 35 23. A field effect transistor, a charge transport or electroluminescent component in an organic light emitting diode, a photovoltaic, photoconductor or a sensor device, a battery electrode or part thereof, an electrophotographic or electrophotographic recording device, a charge injection layer, a Schottky diode, a planarising layer, an antistatic film or a conducting substrate or

pattern comprising a material, component or device according to claim 21.

24. An integrated circuit, thin film transistor, radio frequency identification tag, organic light emitting diode, electroluminescent display, backlight, flat panel display, liquid crystal display, battery or sensor, comprising a material, component or device according to claim 21.
25. A security marking or device, comprising a field effect transistor according to claim 23.
26. A security marking or device comprising a radio frequency identification tag according to claim 24.
27. A polymer according to claim 3, wherein R is an organic group that lowers the surface energy of the polymer.
28. A method of inducing or enhancing the charge carrier mobility or electrical conductivity of a polymer dopant comprising binding at least one electron accepting group to the polymer.
29. A method according to claim 28, wherein the electron accepting group is covalently incorporated in a polymer main chain or covalently bound, optionally via a spacer group, as a side group or part of a side chain, to a polymer backbone.
30. A method according to claim 28, wherein the polymer dopant is a polymer containing recurring units of formula I



wherein

P^{1-3} are, independently of each other, a group forming a polymer backbone,

5 Sp is, each independently, a spacer group or a single bond,

G is an electron accepting group,

10 R is an organic group that modifies the surface energy of the polymer,

m, n, o are, independently of each other, 0 or 1, wherein in each recurring unit of formula I $m + n + o > 0$, and in at least one of these recurring units m is 1, and

15

p is an integer from 1 to 500,000.

20

25

30

35